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VICTORIA.

GEOLOGICAL SURVEYOR'S REPORT.

(WITH PLANS AND SECTIONS.)

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LETTER FROM GEOLOGICAL SURVEYOR TO THE COLONIAL SECRETARY.

Geological Survey,
Brighton, 28th July, 1854.

Sir,

With this I have the honor to forward you my Report, with a Geological Map and Sections of the country I have been engaged surveying since the commencement of February last.

The early setting in of the wet weather obliged me to leave Western Port sooner than I had intended, and before I was able satisfactorily to examine the extension inland of the carboniferous strata of that district, which I had hoped to have effected this autumn, with a view to the determination of their extent, and the probable existence in them of profitably workable seams of coal. I hope to be able to do so, however, early in the ensuing summer.

I now propose carrying on the Geological Surveying and Mapping of the country, from Melbourne northwards to Mount Disappointment; and for this purpose, I propose starting on Tuesday next for the Upper Plenty. I shall then proceed to examine the country lying between the rivers Yarra and Plenty.

Both the Yarra and Upper Plenty Ranges have been reported as being auriferous, but hitherto no satisfactory confirmation of these reports has been obtained.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) ALFRED R. C. SELWYN,
Geological Surveyor.

The Honorable
The Colonial Secretary.

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REPORT

On the Geology, Palæontology, and Mineralogy of the country situated between Melbourne, Western Port Bay, Cape Schanck, and Point Nepean; accompanied by a Geological Map and Sections.

The geological features of the above district are extremely interesting, presenting in a comparatively small area a great variety of formations, the coast lines affording many excellent sections for the examination of the various strata composing them.

These, taken in descending order, are as follows :—

I.—AQUEOUS OR SEDIMENTARY.

1. Blown Sand.
2. Alluvial and Diluvial Deposits.
3. Recently raised Sea or Estuary Beds, containing Shells of existing Species.
4. Tertiary Series.
5. Carboniferous Series.
6. Older Palæozoic Series.

II.—IGNEOUS AND VOLCANIC.

1. Basalts, Lava, and other recent Volcanic Rocks.
2. Basalt, Amygdaloid, Porphyry, and older Igneous and Volcanic Rocks.
3. Granite, Feldspar Porphyry, and Syenite.

The area occupied by these, with the exception of 1 and 2 (alluvial and diluvial), and their general relations to each other, are best seen by referring to the accompanying Geological Map and Sections of the district.

The soil, scenery, and physical features of the country, possess everywhere a marked character, dependent in a great measure on the geological formation ; this alone being often sufficient to determine the nature of the subjacent rock, though for many miles not a fragment is to be seen in place. Thus in the area occupied by the tertiary formation, especially where it attains a considerable thickness, and is not covered by alluvial or diluvial deposits, we almost invariably find a rather barren sandy soil, with very little or no fine timber, but often thickly covered with heath, low scrub, coarse grass, grass trees, and ferns, and very seldom affording good agricultural land : that, on the other hand, occupied by the recent volcanic and other igneous formations, everywhere presents a rich agricultural soil, and forms either well-grassed open plains, or undulating and hilly country, often densely timbered with magnificent eucalypti (stringy bark, iron bark, and gum).

This rich character of the soil wherever the igneous rocks prevail, is so marked and constant, that a mere reference to the Geological Map would, in most instances without previous knowledge of the country, enable any person to select the best agricultural land of the district.

With the exception of the limestones and iron ores of the tertiary and igneous formations, the indications of coal in Western Port, and abundance of good building material (granite, bluestone, freestone, and hard quartzose and ferruginous sandstone, the latter a very durable though not ornamental building stone), there does not appear to be in this district any indication on the surface of the existence of gold or any other mineral or metallic deposit of economic value.

I shall now briefly describe the general geological character of the several formations as seen in the district.

1. Blown Sand,—consisting of hills of loose sand and shells, formed by the action of the wind on the sandy beds of the recently raised sea and estuary bottoms.

2. Alluvial and Diluvial Deposits.—The first of these consists here, as elsewhere, of accumulations of sand, gravel, clay, and decayed vegetable matter, formed from the diluvial and other older stratified and igneous rocks by geological causes still in existence, and which have been in operation since the time when the land assumed its present outline. These accumulations are chiefly found occupying all the low swampy tracts, the banks of creeks and rivers, the bottoms of valleys, and other low-lying flat districts subject to periodical inundations.

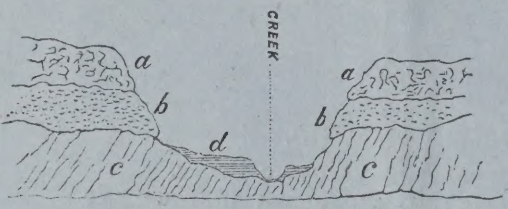
The second, diluvium or drift, consists, also, of accumulations of sand, gravel, clay, pebbles, and angular or more or less rounded fragments of, and rests indifferently on, all the more solid and older rocks, whether sedimentary or igneous.

These accumulations often attain, in situations favorable for their deposition, a very considerable thickness; frequently, for many miles, completely concealing the subjacent rock, the nature of which, however, may in most instances be ascertained by a careful examination of the fragments contained in these deposits, as in very few cases do they bear any evidence of having been transported from a distance.

All these diluvial accumulations are probably the result of geological causes not now in operation, and which, apparently, ceased to exist at the time the greater portion of the country assumed its present outline. To this period may be referred all the auriferous drifts, with the exception of those accumulations re-formed chiefly from the latter, by recent alluvial and fluviatile action.

Referable to this period,* and well seen in several places in and around Melbourne, resting on the palæozoic strata and older basalts, are small patches of a peculiar, very rounded, quartz gravel, in lithological character very similar to some of the auriferous deposits on the White Hills of Bendigo and Forest Creek. North of Melbourne this bed is found to pass into a very hard quartz conglomerate, or pudding stone, and is seen resting on palæozoic sandstone and shale, and underlying the recent lava, or bluestone, which forms the extensive open plains near Keilor. In the district under consideration, the diluvial formation exists over large areas; but from the nature of the rocks on which it now rests, and from which it has in most instances been derived, I should not anticipate its proving auriferous to any extent. I may here mention, that near the junction of Fryer's Creek and the Loddon, this diluvial, or drift formation, which in that district is highly auriferous, has been reached by sinking, I believe, near 30 feet through recent basaltic lava, or bluestone, proving the latter to be of more recent origin than the diluvial auriferous drifts.†

SECTION NEAR KEILOR.



a. Recent Basalt.
b. Tertiary Gravel.
c. Older Palæozoic Rock.
d. Alluvial.

3. Recently Upheaved Sea and Estuary Beds, containing Shells of existing Genera and Species.—Wherever cliffs occur along the line of coast from Melbourne to Point Nepean, these beds may be distinctly seen resting indifferently on either the granite, basalt, palæozoic, or tertiary strata, also forming all the low shores where no other rocks are seen in place. They consist chiefly of beds of loose sand and clay, with layers of shells (oysters, muscles, periwinkles, cockles, limpets and other shells, perfectly identical with those now found living on adjacent shores), but in several places from 100 to 300 feet above the level of the sea, and from 5 to 6 miles inland.

These recent beds apparently occupy under the alluvial soil, and attain their greatest thickness in all the extensive flat marshy lands bordering the Bay, viz.:—that extending from the mouth of the Yarra to Melbourne on one side, and St. Kilda on the other; the swampy ground between St. Kilda and Brighton, again from Moodialloc to Mount Eliza, embracing the Carum Swamp, between Mount Martha and Arthur's Seat, where they probably rest on granite, and again the whole of that peculiar sandy calcareous district extending from Arthur's Seat south to Cape Schanck and west to Port Nepean, may, I think, be referred to these recent formations, as in them I have been unable to find any shells except such as are found still living in the adjacent sea, these latter or fragments of them being extremely abundant.

Bones have also been found in it, supposed to be the remains of some small marsupial animal, further tending to prove the very recent origin of these strata.

Between Sandridge and Melbourne, these beds have been proved to a depth of fifty feet, by a series of borings recently executed by Mr. Christie. In all the bores he has obtained recent shells, at various depths from the surface to about 30 feet: the accompanying section along the line of borings, I have drawn from data furnished by Mr. Christie; and an examination which he has kindly permitted me to make of the specimens obtained from each bore, at every one or two feet.

At Cape Schanck these beds are 40 to 50 feet thick, resting perfectly horizontal on the older basaltic rocks, which here form cliffs from 200 to 300 feet in height.

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* Subsequent observation inclines me to consider this gravel bed as a portion of the tertiary series.

† This fact was recently communicated to me by a gentleman resident on Fryer's Creek, and engaged in mining. When I visited the locality, I saw strong evidence of such being the case; but no holes had then been sunk through the basalt, and, for want of a natural section of the strata, was unable to satisfy myself of the actual existence of the diluvial auriferous drift between the basalt and the older palæozoic sandstones and schists.

With respect to the origin of the limestones of this district, now affording a supply of lime for the Melbourne market, I have no doubt that they have been formed subsequently to the upheaval of the sandy strata, in which they are now found, and are due to the percolation of rain water, dissolving and taking up the carbonate of lime of the shells contained in the sand, and re-depositing it as limestone, during the evaporation of the water, in the irregular cakes and patches in which it is now found.

As a general description of this district lying south and west of Arthur's Seat, I can hardly do better than quote the words of my friend and late colleague, Mr. Jukes, now Director of the Irish Geological Survey, where, in speaking of a district in Western Australia, on the Swan River, he says,—"It consists partly of grains of quartz, and partly " of calcareous grains, probably rolled fragments of shells and corals; in places, it passes " into a soft friable limestone, sufficiently firm to be used for building. In other places are " seen rising from the sand, what appears to be trunks of fossil trees, having not only the " external forms of trees, but much even that resembles their internal structure. In a little " cliff near Freemantle, however, near the entrance of the Swan, I saw some of these " dendritic masses, fully exposed, and, from their peculiar structure and conformation, I " believe them to be nothing more than stalactites formed in the sand by the percolation " of rain water, dissolving and taking up the carbonate of lime, and re-depositing it in " fantastic forms, wherever a predisposing cause happened to determine it. I believe the " limestone in these sands to be formed in the same way, as the bedding has frequently a " rather highly inclined or contorted dip, evidently not due to movements of elevation, but " the result of their original formation." This description applies in every particular to the district under consideration.

The cliffs on the Back Beach afford a splendid illustration in the most varied and fantastic form of the dendritic calcareous masses described by Mr. Jukes; and that they have been formed in the manner suggested by him, there cannot, I think, be the slightest doubt. Freestone of very good quality is also abundant in this part of the beach, and might be obtained in blocks of almost any dimensions. A quarry has been opened in it on the Port Phillip shore, near Point Nepean, where, though not of so good a quality, it is more easy of access.

4. TERTIARY SERIES.—The best sections of this formation, are to be seen on the coast between Tangenong Creek and Mount Martha, exposed in cliffs, in places upwards of 200 feet in height.

The beds are everywhere found resting horizontally, or nearly so, indifferently on all the older formations, whether stratified, granitic, or igneous, and consist of—

1st. Soft, red, and brown, rather gritty, ferruginous sandstone, with nodules, and masses, of all shapes and sizes, of hard metallic-looking mammilated and concretionary ironstones,* and numerous fossil shells, also spatangi and fossil wood.

2nd. Various shades of yellow, red, white, chocolate colored, and mottled sands, with bands of quartz grains and pebbles, or soft friable sand rock, often clayey.

3rd. Large irregular beds and masses of very hard ferruginous quartz grit and conglomerate, used as building stone.†

4th. Stiff blue clay, containing bands and septaria of hard grey argillaceous limestone, and veins of crystallized gypsum (selenite). This bed is only seen in two places, indicated on the map, and appears to form the lowest portion of the tertiary series exposed in the district.

Both the clay and limestone are very rich in fossil remains, and both in general lithological character, mineral and organic contents, bear a striking resemblance to the clay and associated calcareous nodules of the London and Hampshire basins.

Whether any of the shells here found are identical with those of the English or European tertiaries, will have to be determined; those I have collected from this bed are now in the possession of Mr. Blandowski, Curator of the Museum of Natural History, for the purpose of being figured and described by him.

Fossil shells have also been found in the ferruginous sandstone at Prahran, in sinking a well; and near Flemington, resting on basalt or bluestone; these latter beds bear strong resemblance to the craig of Suffolk, but are commonly more impregnated with iron, which frequently entirely replaces the calcareous matter of the shells contained in them. The relative position in the tertiary series of these fossiliferous beds at Flemington, and those of Brighton, is at present uncertain.

At Flemington, they are of small thickness. The greatest exposed thickness of the tertiary series is from 200 to 300 feet, in the sea cliffs between Mount Eliza and Mount Martha; even here, however, the lowest beds are not exposed.

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* A specimen of this ironstone, assayed by Mr. Davey, gives 67 per cent. of iron, and a very little titanium. Titaniferous iron sand is also found in abundance on the sandy beach at Brighton, derived from the tertiary strata.

† Brighton church is built of stone obtained from these beds; also the house of J. B. Were, Esq., at Brighton. It is also used near Flemington, where it forms a capping on the palæozoic, and older basaltic rocks, a specimen of this.

On this portion of the coast are seen several dykes of concretionary or semicolumnar augitic basalt, in places decomposed externally into a soft argillaceous earth, somewhat difficult to distinguish from the adjacent tertiary clay, they appear to upheave and dislocate the tertiary strata on either side without altering them, and are intersected by veins from 1 to 6 inches in thickness, of a very hard whitish rock, apparently containing a large per centage of iron, and presenting externally a glazed coating of red oxide of iron.

It occasionally assumes a mammilated or concretionary form, and the appearance of a rather rich hematitic iron ore. The limestone before mentioned as occurring in this locality, though in no great quantity, is of excellent quality, and might be found highly valuable for making hydraulic cement.

Calcareous nodules of a precisely similar nature are extensively collected for that purpose from the London clay, the cliffs of Hampshire, the Isle of Sheppey, and elsewhere on the south and east coasts of England.

5. CARBONIFEROUS SERIES.—These rocks are composed of—

1st. Yellow, olive brown, brown, and greenish colored, rather soft, often micacious sandstone, sometimes passing into a hard quartz grit, or conglomerate.
2nd. Beds of dark blue, grey, and black shale, grey sandy breccia, with a few beds of bitumenous coal, of excellent quality, and numerous fine thin streaks and small patches of carbonaceous matter; also numerous ferruginous and calcarious veins, nodules, and concretions.
3rd. Large fragments of fossil wood, stems and branches of trees, and impressions of stalks and leaves of plants.

A full description of all these beds, as seen on the coast from Griffith's Point to Anderson's Inlet, has been given in my report on the Cape Patterson coal formation. I may as well again state my opinion, that although there is no sufficient evidence to be seen on the above line of coast to enable me to affirm with certainty (as has been done) that extensive, thick, and profitably workable seams of coal exist in the district, there is still enough to prove—

1st. That there is in this locality a thick and wide-spread formation of carboniferous strata.
2nd. That they contain in places coal of excellent quality, though in thin seams and apparently not persistent, but rapidly thinning out in all directions.

This, however, being the case, combined with the fact that on the coast, the only place where evidence of any kind has as yet been seen, only a very small portion of the total thickness of the carboniferous formation is exposed, there is both a possibility and a likelihood that some lower and not exposed portion of the formation contains thicker and more persistent beds of coal. This matter might be very easily proved, without further outlay than would be incurred by the execution of a series of borings at proper intervals and to sufficient depths.

Owing to the rather early commencement of the wet season, and the almost impenetrable nature of the country, I have been unable as yet to examine the extension or determine the limits of the carboniferous formation, inland, towards the rivers Bass and Powlett. With the exception of the two small patches seen on the south shore of French Island, underneath the tertiary beds, there are no indications of the carboniferous rocks having extended to the west and north-west shores of Western Port Bay.

Whether any, or how much larger area than that shewn on the accompanying map is occupied by them in French Island, it is impossible to determine, as in attempting to trace them from the coast, inland, they are found to be entirely concealed by the red, yellow, and white sands, and sandstones of the tertiary formation; there is, however, little probability of their extending beyond a trap range, which runs east and west through the centre of the island.

This trap or basalt is, in all probability, connected with the great mass of basalt extending eastward from Cape Schanck and Arthur's Seat. In the intervening portion of country, however, from Hann's Station to Sandy Point, with the exception of a few small patches of ferruginous tertiary sandstone, no rocks of any description are to be seen; the country is flat, and the soil commonly rather sandy.

From the small average dip of the beds which I have here called the carboniferous series, and from the marked difference in their general lithological character, both in French Island, and on the main land near Griffith's Point, and thence to Cape Patterson and Anderson's Inlet, I believe them to be perfectly distinct from, and to rest unconformably on, the older palæozoic rocks. The evidence on this head is, however, at present very imperfect.

The only fossil organic remains I have found in these beds are vegetables—stems of trees, and impressions of leaves and stalks of various plants. The best collection I have seen of the latter, was obtained some years ago by Mr. Smythe, of the Surveyor General's department, and appear to be species allied to Sphenopteris, Glosopteris, &c., found in the New South Wales coal formation.

6. Older Palæozoic Series.—These consist of—

1st. Rather thin and regularly bedded white and brown, often very micacious sandstones.

2nd. Hard, white quartzose sandstones, quarried at St. Kilda, and on the south bank of the Yarra, for building and road material.

3rd. Very hard, crystalline, feldspathic, grey, brown, and red micacious sandstone, and beds of hard, dark blue, indurated slates and shales.

4th. Very soft yellow and brown argillaceous and arenaceous shales.

No. 3 are seen only on the flanks of Mount Eliza, Mount Martha, and Arthur's Seat, and their crystalline character is probably due to alteration caused by the intrusion of the granite forming those hills.

On the Bald Hill range, east of Arthur's Seat, and near Balcomb's Station, these beds are best seen. They are here intersected with numerous small veins of white quartz, fragments of which lie scattered on the surface. This and their similarity in general appearance to the metamorphosed palæozoic strata in the neighbourhood of Mount Alexander, and other gold fields, have induced people in the neighbourhood to search for gold in them. Several holes have been sunk, but, so far as I could learn, hitherto without success. It is, however, quite possible that gold might be found in them in small quantities.

With the exception of the above ranges, the creeks near Balcomb's Cattle Station, and on Sandstone Island, in Western Port Bay, there are in this portion of the palæozoic area no sections which enable one to determine the direction in which the beds are dipping.

To the north, however, in Melbourne, St. Kilda, Richmond, and on the south banks of the Yarra, the palæozoic strata are well exposed in quarries and natural sections. They are here seen dipping both east and west, at high angles from 25° to 80°, with an average N.N.E. strike.

In several of the quarries on the south bank of the Yarra, at Richmond and in Collingwood, casts of fossil shells are abundant, apparently species of Spirifer, Orthis, Atripa, &c.; among them are, I think, Orthis Australis and Atripa Jukesii.*

The only mineral I have seen in these rocks is graphite. This occurs in a very impure state, and in small quantities, in nests and cavities in the St. Kilda white sandstone.

From the sandstone strata of the palæozoic series abundance of good, durable, rough building stone may be obtained, and in places good freestone, both in slabs and blocks of moderate size. It is, however, almost invariably more or less stained and discolored by oxide of iron, and probably not of the most durable character as a building material, when exposed to atmospheric action.

II.—IGNEOUS AND VOLCANIC ROCKS.

1. Basalts, Lava, and other recent Volcanic Rocks.—These are not seen in the district under consideration to the south of the River Yarra. On the north bank of the river they are extensively quarried, and afford the bluestone so much used in and around Melbourne for building.

1st. It occurs in large imperfectly columnar or spheroidal masses, the joints or planes of cooling and crystallization, consequent on this structure, affording great facilities to the quarrymen in obtaining blocks of convenient size. This is well seen in a quarry where the Upper Plenty Road crosses the Merri Creek, the columnar structure being there very perfect; the rock itself is commonly a dark blue, fine-grained basalt, apparently composed of augite, feldspar, and iron; it is always more or less vesicular, sometimes so much so as to render it unfit for building material. These vesicles are coated with small mammilated crystals of white carbonate of lime, having a somewhat silky lustre; small crystals of olivine are also occasionally found in it.

2nd. In beds, or masses, either broken up into rubbly angular fragments, or consisting of an aggregation of roundish nodules of very hard black, or dark blue basalt, enclosed in a soft, earthy, decomposed steatitic and feldspathic rock. These beds afford the best material for road making, as the nodules abovementioned are never vesicular, much harder and finer grained than those portions from which the bluestone for building is obtained, and are also readily quarried without the aid of blasting. The above character is more common in the older basalts. With respect to the age and origin of these basalts, they are, I believe, the products of volcanoes of the diluvial or post-diluvial period, and have flowed down, and partially filled up the then existing valleys, indifferently resting on and covering all the older rocks, whether tertiary, palæozoic, granitic, or igneous.

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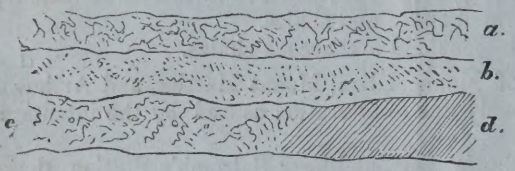
* Mr. Smythe, of the Surveyor General's department, was, I believe, the first person who discovered these fossils near Melbourne. He has, I believe, also found species of Trilobites and plants in these beds. I have found one species of Trilobite, a star fish, an Orthoceras, and a shell like a Lingula.

When resting on the latter, from the similarity in lithological character, it becomes almost impossible to define their respective limits, unless some portion of the tertiary series or other recent sedimentary rocks intervene, as represented in the accompanying sketch, where *a* is recent basalt; *b*, tertiary gravel; *c*, older basalt; and *d*, palæozoic sandstone and shale.



The trap, or basalt, of Batman's Hill, extending north towards Flemington, as also of Emerald Hill, belong, I believe, to the older igneous period. In support of this opinion, I may mention that we find resting on Batman's Hill, what appears to be the remains of a portion of the same quartz gravel bed which, as before mentioned, is seen underlying the basalt to the north of Melbourne.

That the basalt to the east of Melbourne has nothing whatever to do with the upheaval of the adjacent palæozoic strata, and has not even been erupted where we now find it, but has merely flowed in a melted state over their upturned edges, is, I think, well proved by the present limits of the lava, following as it does the present bank of the river; the course and direction of the present river, and the old lava stream having evidently been determined by the general level and outline of the country through which they have flowed.

2. Basalt, Amygdaloid, Porphyry, and older Igneous and Volcanic Rocks.—These, as before stated, often bear a strong resemblance in lithological character to the preceding, but, unlike them, appear to have been erupted, *en masse*, in the district they now occupy; probably, at a period not long subsequent to the formation of the carboniferous series. The principal area occupied by them extends eastward from Arthur's Seat to Cape Schanck, embracing nearly the whole of the islands and southern shores of Western Port Bay. They consist of—

1st. Masses of very hard, augitic, black, often columnar basalt, containing olivine, mesotype, and crystallized carbonate of lime, in nests and cavities, but seldom or never passing into a scoriacious trap, or having the appearance of a subærial lava.

2nd. Associated with the above, in irregular beds and masses, is a very soft brick red, brown, and yellowish steatitic trap, presenting either an amygdaloidal, porphyritic, or marbled appearance.

3rd. Very soft, decomposed, greenish brown, steatitic, earthy trap, full of small concretionary nodules of hard black basalt. On the sea beach these nodules become liberated by the decomposition and washing away of the softer portion of the rock, and often lie thickly scattered along the shore, appearing at first sight like beds of very large rounded pebbles of basalt.

4th. Large mammilated and concretionary masses of red and brown hematitic iron, associated with a stiff, pure white, feldspathic, and yellow or red ochreous clay, probably the result of the decomposition of the trap. This iron ore occurs chiefly in the largest masses along the shores east of Settlement Point.

3. Granite, Feldspar Porphyry, and Syenite.—The granites of this district present no peculiar features, being composed commonly of quartz, reddish colored feldspar, and black mica; the two latter, however, occasionally vary in color, the mica being yellow and the feldspar white.

The sea cliffs under Mount Martha present the greatest facilities for quarrying and shipment, and any quantity, of excellent quality for building, might, I think, be obtained from this locality.

Feldspar Porphyry and Syenite.—These two rocks occur as narrow dykes, cutting through and upheaving the older palæozoic rocks, the former both on the south banks of the Yarra, and to the north of Melbourne, and the latter near Dandenong.

I shall now conclude with a few remarks on the auriferous and other palæozoic rocks.

First, then, with respect to the name, "Palæozoic," which I have made use of in describing the older clay-slates, shales, schists, and sandstones, both in this and in my former report on the auriferous rocks of Mount Alexander, Bendigo, &c., and which has elicited some not very complimentary remarks in both the Colonial and English journals, at my expense, I may state—

1st. That the name palæozoic, merely implies that the rocks are probably referable to some portion of the Carboniferous, Devonian, or Silurian epoch, and that they are neither the so-called Primary rocks of some geologists, nor the "metamorphosed granite" of Mr. Evan Hopkins.

2nd. That (however startling it may appear to the latter gentleman and his disciples) I now have found abundance of organic remains, casts of shells, apparently species of orthis, spirifer, atripa, &c., also euonphalas and other univalves, both in the auriferous rocks at McIvor and the clay-slates, shales, and sandstones near Melbourne ;* and I have little doubt that a closer and more extended examination of the auriferous schists generally, will prove them all to be merely upheaved and metamorphosed palæozoic strata, or, in other words, containing traces of ancient life.

At present little or nothing being known of the relative geological position of these rocks in different districts, it is impossible to determine their age; failing this evidence of super-position, however, I should, from their highly inclined position, the more metamorphosed character, and the intense cleavage which has affected them, be inclined to consider the rocks of Forest Creek, Bendigo, and other Gold Fields, as forming the lower portion of the series, and the clay-slates, shales, and sandstones near Melbourne, which are commonly found dipping at comparatively low angles, very little if at all metamorphosed, and exhibiting little or no trace of cleavage, to constitute some portion of the upper part of the same series.

The difference in all these repects is much the same as is seen to exist between any position of the lowest Silurian slates of North Wales, and the upper Ludlow shales and sandstones.

Irrespective of the geological age of the rocks, I should consider that those portions of the country in which the palæozoic strata have undergone the greatest amount of upheaval, metamorphism, and dislocation, are in all cases the most likely to prove auriferous.

The best guide, however, in searching for auriferous tracts, is, I believe, the existence of quartz veins. In districts where little or no dislocation and disturbance of the strata has taken place, and where consequently few or no quartz veins have been formed, it is highly improbable that much gold would be discovered. In such districts, on the other hand, where a very considerable amount of upheaval, metamorphism, and dislocation of the strata has been effected, and in consequence numerous and extensive quartz veins may have been formed, the probabilities are highly in favor of the existence of gold and other metalliferous deposits. This is borne out by the position and course of all the richest worked gold fields, which are invariably found following and gradually extending themselves on the bearing of some extensive system of quartz veins, such as those of Mount Franklin, Forest Creek, and Bendigo, or Ballaarat, Daisy Hill, and Korong, with intervening granitic tracts, such as that extending from the Coliban to the Loddon, through Mount Alexander and Tarrangower.

A good many theories have lately been advanced with respect to the origin of these auriferous quartz veins. I have before stated my opinion, that they are the source whence the whole of the gold now found in diluvial drift has been derived. With respect to their age and origin, at least in the Bendigo, Forest Creek, Tarrangower, Korong, and Daisy Hill Districts, I believe that they, or more properly, the fissures and cracks they now occupy, are either contemporaneous with, and the result of, the upheaval and dislocation of the older palæozoic strata, caused by the intrusion of the granites now seen on the surface; or that they are the result of dislocations and upheavals which had affected these older sedimentary deposits prior to the formation of these granitic masses, by the intrusion of which, they—the quartz veins—have been cut off.

I am led to this conclusion from the fact, that, however strong, numerous, and persistent these quartz veins may be, they are found, as it were, abruptly terminated on striking the granite, the auriferous deposits, of course, terminating also; a fact which tends further to prove the quartz veins to be the sources of the gold, and that the granite has not undergone the action, of whatever nature it may have been, which caused the formation of these veins.

I can give no better instance of this than is found in the great non-auriferous granitic tract lying between the Rivers Coliban and Loddon, and completely separating the Bendigo from the Tarrangower and Forest Creek Gold Fields; and there certainly appears no reason, unless one or other of the above suppositions be correct, why the granitic districts should not produce gold equally with those occupied by the sedimentary strata.

As regards the question of "second bottoms," which has excited considerable discussion, and the waste of a large amount of time and labor, I may state my conviction, that all such attempts must invariably end in disappointment and loss to those engaged in them. The real bottom is the solid rock, which has never been removed by denudation; and when that has once been reached, it is quite impossible that diluvial auriferous deposits can be found by sinking a greater depth through solid rock.

The accompanying sketch, No. III., represents a section across almost any auriferous gully of the gold fields, and at once shews the uselessness of these attempts.

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* Since writing the above, I have collected numerous other species of Silurian fossils, from various localities.

2/60

When at Korong, I found a digger busily engaged sinking a shaft on the top of a range, in the solid schist and sandstone, immediately above one of the auriferous diluvial flats, with the firm conviction that the auriferous drift of the flat below, passed underneath the hill, and that he should certainly find it by sinking some 50 or 60 feet to the level it occupied in the valley. Some such notion it must be, I fancy, which induces diggers to waste their time and money searching for "second bottoms."

I do not by this mean to assert that no gold can be found in sinking after the line, *b c*, section III., has been reached, but merely that no more diluvial auriferous drift can exist below that point; any operation extending to a greater depth than the above line, at once ceases to be what may be strictly termed digging, and becomes mining, perfectly similar in its nature and results to the mining now carried on in quartz veins at the surface, and the one as unlikely as the other to lead to the discovery of any auriferous drift deposit. In the latter case, no miner would for a moment imagine such a thing possible. Why, then, in the former? As well might a tin-miner in Cornwall expect to find "stream tin" in the depth of the mine, as the digger to find a mechanical deposit of gold after sinking through 5, 20, or 50 feet of solid rock.

With respect to the permanency of the supply of gold, I have no hesitation in stating my belief,

1st. That the Gold Fields of Victoria will prove as permanent a source of wealth to this Colony as the Tin and Copper Mines of Cornwall to Great Britain.

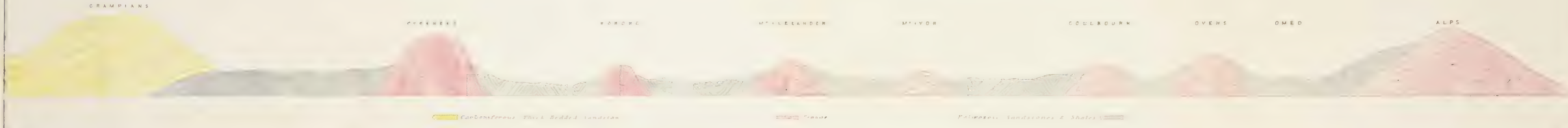
2nd. That there are hundreds of square miles of country yet untouched by the pick of the digger, which present all the geological and surface indications of the existence of gold, in as marked a degree as any one of the present known and worked Gold Fields.

The great longitudinal extent of the auriferous deposits is a fact, not difficult of explanation, when we regard what appears to be the general geological structure of the country, which, in making a section from east to west, or from the Australian Alps to the Pyrenees and Grampians, is found to consist of a succession of steep hills, ranges, and gullies, composed of an enormous thickness (30,000 feet, or more,) of upheaved and contorted palæozoic and older strata, intercepted by great masses of granitic and other apparently non-auriferous plutonic rocks, with extensive intervening tracts of recent igenous or volcanic rocks, forming plains and table lands, also non-auriferous, but, in all probability, often resting on and concealing auriferous deposits.

This highly contorted character of the auriferous rocks, causes them to recur again and again at the surface, and thus to occupy a much greater breadth of country than the same thickness of strata could do, if merely dipping in one direction at a uniform low angle. In sketch No. IV. (being an imaginary sketch from the Australian Alps to the Grampians), I have attempted to illustrate this, and to shew what I conceive to be the general geological relation of the rocks of the great auriferous valleys lying between the above-named ranges.

By Authority: John Ferres, Government Printer, Melbourne.

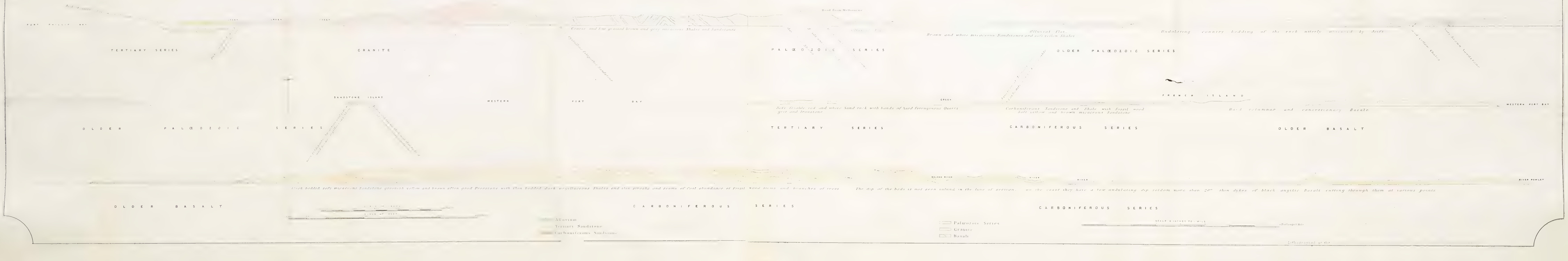
IMAGINARY SECTION SHEWING THE GEOLOGICAL RELATIONS OF THE AURIFEROUS ROCKS FROM THE GRAMPIANS TO THE ALPS



Lithographed at the Surveyor General's Office Melbourne Decr 15th 18[illegible] by A Robertson

SECTION from PORT PHILLIP BAY over Mt ELIZA across WESTERN PORT BAY and FRENCH ISLAND to the RIVER POWLET

General line of bearing E 30° S and W 30° N



MOUNT ELIZA
PORT PHILLIP BAY
CREEK
CREEK
CREEK
TERTIARY SERIES
GRANITE
Course and fine grained brown and grey micaceous Shales and Sandstones
Crystalline felspathic Sandstone
Road from Melbourne
PALÆOZOIC SERIES
Alluvial Flat
Brown and white micaceous Sandstones and soft yellow Shales
OLDER PALÆOZOIC SERIES
Undulating convex bedding of the rock utterly unnoticed by drift
SANDSTONE ISLAND
WESTERN PORT BAY
OLDER PALÆOZOIC SERIES
Soft friable red and white Sand rock with bands of hard ferruginous Quartz grit and Ironstone
CREEK
TERTIARY SERIES
Carboniferous Sandstone and Shale with Fossil wood
Soft yellow and brown micaceous Sandstone
CARBONIFEROUS SERIES
FRENCH ISLAND
Hard columnar and concretionary Basalt
OLDER BASALT
WESTERN PORT BAY
RIVER POWLET
Thick bedded soft micaceous Sandstone greenish yellow and brown often good Freestone with thin bedded dark argillaceous Shales and thin streaks and seams of Coal abundance of fossil wood stems and branches of trees
The dip of the beds is not seen inland in the line of section, on the coast they have a low undulating dip seldom more than 20° thin dykes of black augitic Basalt cutting through them at various points
OLDER BASALT
CARBONIFEROUS SERIES
CARBONIFEROUS SERIES
SCALE OF YARDS
SCALE OF FEET
Alluvium
Tertiary Sandstone
Carboniferous Sandstone
Palæozoic Series
Granite
Basalt
SCALE 6 INCHES TO 1 MILE
Furlongs 1 Mile
Lithographed at the

GEOLOGICAL SECTION OF THE SHIP CANAL

between

HOBSON'S BAY AND THE RIVER YARRA YARRA

SECTION FROM A TO B

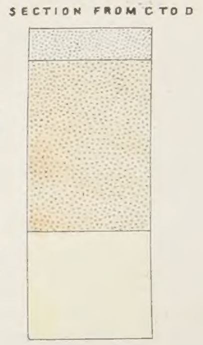
Level of high water

" " low water

Sand and recent shells

Black mud, with fragments of shells and much decayed vegetable matter, probably old tide way, or river channel gradually undergoing depression.

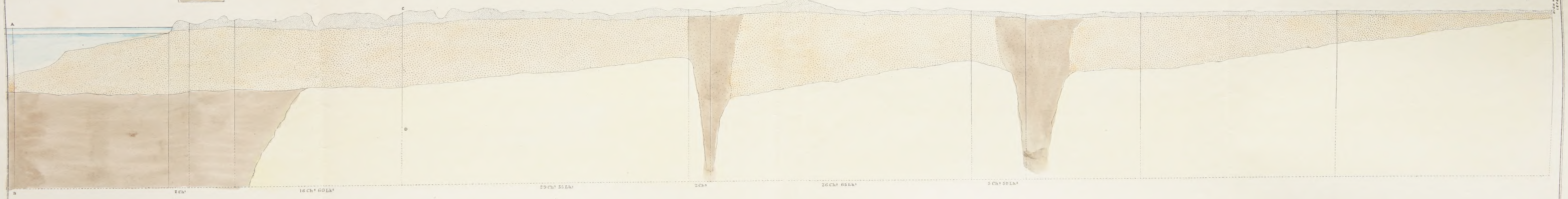
SECTION FROM C TO D

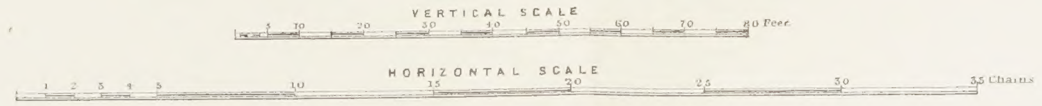


Blown Sand

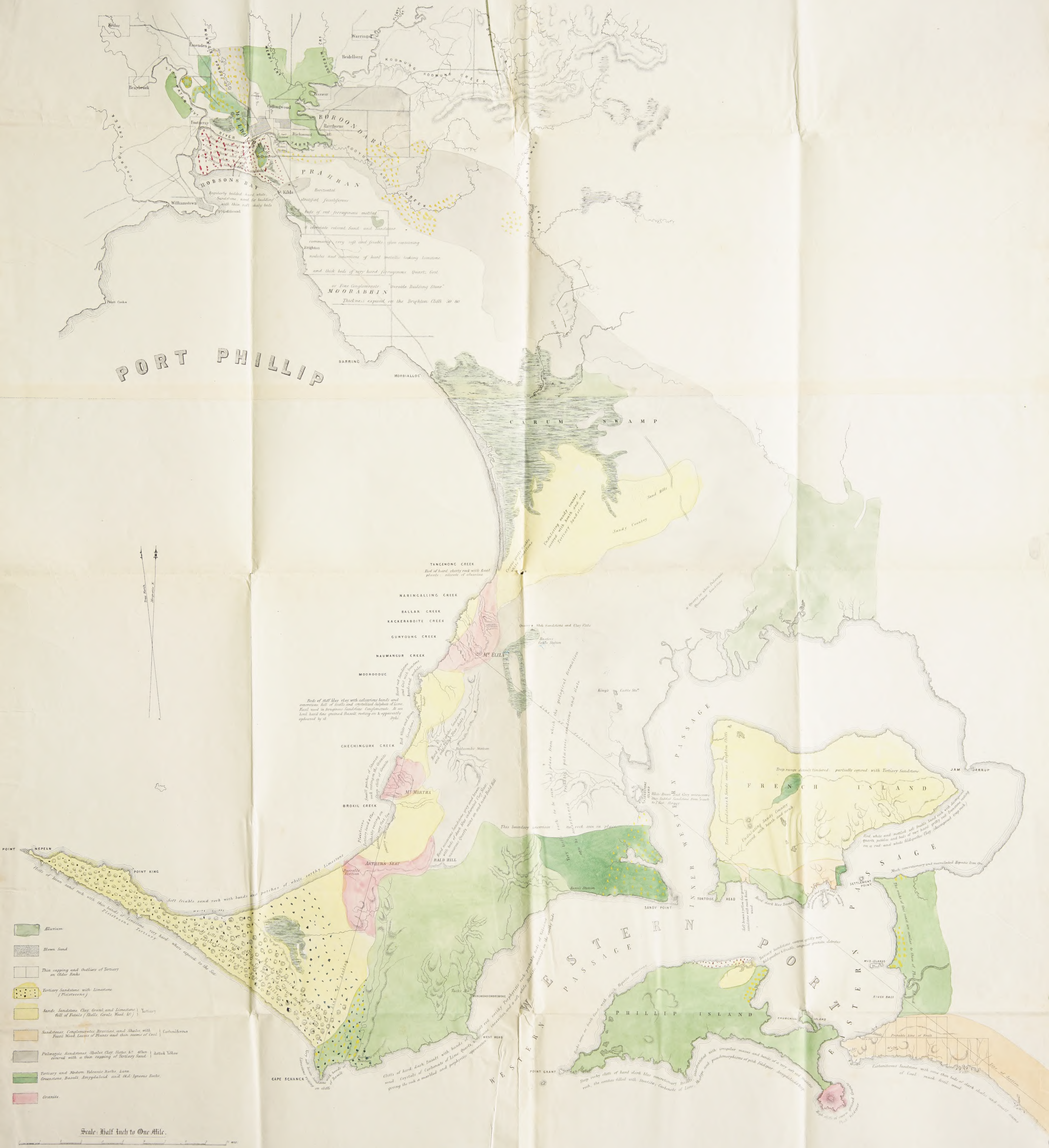
Shelly beds of sand, recently raised sea and estuary bottom.
(PLEISTOCENE)

Red, ferruginous, mottled, and sandy clays, brown white quartzose grit, older tertiary. Similar to Brighton Cliff, Red Bluff &c.
EOCENE OR MIOCENE





Lithographed at the Surveyor General's Office, Melbourne. Decr 29th 1854, by A. Robertson



Keilor
Essenden
Braybrook
Footscray
Moonee Ponds
Merri Crk
Darebin Crk
Plenty Rr
Warringal
Heidelberg
Koonung Koonung Creek
Dep Creek
Salt Water Rivr
Kororoit Creek
Collingwood
Reserve
Boroondara
Hawthorne
Richmond
Melbourne
Yarra Yarra River
Kooyong Koot Creek
Dandenong Creek
Sandridge
Hobsons Bay
Regularly bedded hard white Sandstone used for building with thin soft shaly beds
Williamstown
Pt Gellibrand
St Kilda
Prahran
Horizontal stratified fossiliferous beds of red ferruginous mottled & chocolate colored Sand and Sandstone commonly very soft and friable often containing nodules and concretions of hard metallic looking Ironstone and thick beds of very hard ferruginous Quartz Grit or Fine Conglomerate "Durable Building Stone"
Brighton
Moorabbin
Thickness exposed on the Brighton Cliffs 50 80
Point Cooke
PORT PHILLIP
Barring
Mordialloc
Carum Swamp
Course gritty friable white Sandstone
Undulating sandy country covered with heath and scrub Tertiary Sandstone
Sandy Country
Sand Hills
Tangenong Creek
Bed of hard cherty rock with fossil plants: silicate of alumina
Naringalling Creek
Ballar Creek
Kackeraboite Creek
Gunyoung Creek
Naumangur Creek
Mooroodoc
Quarry + White Sandstone and Clay Slate
Baxters Cattle Station
Mt Eliza
Hard red Sandstone and Grit with Ironstone bands and nodules
Beds of stiff blue clay with calcarious bands and concretions, full of fossils and crystalized Sulphate of Lime. Fossil wood in feruginous Sandstone Conglomerate. At sea level hard fine grained Basalt resting on & apparently upheaved by it.
Dyke
Red White and Brown Sandstone
Hard grey felspathic Sandstone and indurated Blue shale
Balcombs Station
Chechingurk Creek
Small patches of Silurian rock resting on the Granite Steep cliffs of Granite
Mt Martha
Brokil Creek
Pleistocene Tertiary Sand & Clay probably resting on Granite very flat low country with rich soil
Hard micaceous Sandstone grey and brown with beds of dark blue indurated Clay Slate; numerous Quartz veins on and near Bald Hill
Bald Hill
Arthur's Seat
Burrells Station
King's Cattle Stan
Line of Section
Very little rock to be seen in place from which the geological formation can be ascertained probably palaeozoic sandstone and slate
Sandstone Island
White Brown and Grey micaceous thin bedded Sandstone from ¼ inch to 1 foot. Flaggs
This boundary uncertain no rock seen in place
Ranns Station
Sandy Point
Inner Western Passage
Tortoise Head
Soft brown & yellow fine grained sandstone with much fossil wood
Hard dark blue Basalt
Tertiary Sandstones & Sands same as Brighton Cliffs
Trap range densely timbered partially covered with Tertiary Sandstone
French Island
Undulating Sandy Country covered with heath and scrub
Red white and mottled soft friable Sand rock with decomposed quartz pebbles and beds of very hard gritty red Ironstone resting on a red and white feldspathic Clay (decomposed trap rock)
Jam Jerrup
Much concretionary and mamilated Hepatic Iron Ore
Settlement Point
Eastern Passage
The rocks of this coast are similar to those of Phillip Island
Mud Islands
River Bass
Western Port
Tertiary Sandstone coarse gritty very feldspathic & friable, angular granitic detritus
Western Passage
Probably beds of Volcanic ... white Steatitic mineral in the earthy beds
Point Nepean
Point King
Cliffs of brown sand rock with thin bands of Limestone very hard where exposed to the Sea
Pleistocene Tertiary
Soft friable sand rock with bands and patches of white earthy limestone
White Cliffs
Sandy hills earthy limestone
Sand Hills shells and bands and patches of soft white earthy sand rock Fossil Bones & Shells
Cape Schanck
Very soft brown Sandstone Limestone resting with bands of Basalt on cliffs
Barkers Station
Tuck's Stan
Meremendiewokewoke
West Head
Cliffs of hard dark Basalt with bands of soft red earthy Porphyritic rock probably beds of Volcanic mud. Crystals of Carbonate of Lime, Quartz, & Olivine in cavities, and a soft white Steatitic mineral in the earthy beds giving the rock a marbled and porphyritic appearance.
Point Grant
Rocks same as South Coast with much Hepatic Ironstone
Phillip Island
Churchill Island
Steep rocky cliffs of hard dark blue concretionary Basalt interstratified with irregular masses and bands of a very soft red steatitic rock, the cavities filled with Steatite, Carbonate of Lime, Mesotype and pseudomorphisms of pink Feldspar. Amygdaloidal trap
High cliffs of course grained Granite Pink Feldspar
Fault
Probable Line of Fault
Carboniferous Sandstone with some thin beds of dark shales and small seams of Coal much fossil wood
Line of Section
True North
Magnetic N
Alluvium
Blown Sand
Thin capping and Outliers of Tertiary on Older Rocks
Tertiary Sandstone with Limestone (Pleistocene)
Sands, Sandstone, Clay, Gravel, and Limestone full of Fossils (Shells, Corals, Wood, &c) } Tertiary
Sandstones, Conglomerates, Breccias, and Shales with Fossil Wood, Leaves of Plants and thin seams of Coal } Carboniferous
Palæozoic Sandstones, Shales, Clay Slates, &c often covered with a thin capping of Tertiary Sand } dotted Yellow
Tertiary and Modern Volcanic Rocks, Lava
Greenstone, Basalt, Amygdaloid and Old Igneous Rocks.
Granite.
0
1
2
3
4
5
6
7
8
9
10 Miles

Scale: Half Inch to One Mile.

Lithographed at the Surveyor General's Office, Melbourne December 30th 1854. by R. Meikle.